NATURAL GAS EXPLORATION IN THE FRASER VALLEY

INFORMATION BOOKLET

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

August 1991

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FRASER VALLEY NATURAL GAS EXPLORATION

In October, 1989 Conoco Canada Limited was granted petroleum exploration rights to selected portions of the Fraser Valley. They have now requested approval to drill a natural gas well in the area. The attached map indicates the proposed well location.

Conoco is entitled to drill the well, provided they meet all requirements necessary to ensure public safety and environmental security and have made arrangements with surface owners. To further protect against any occurrence that may affect public safety, the Energy Resources Division has imposed Special Well requirements for this East Delta well, with special conditions to minimize the possibility of an uncontrolled release of natural gas. The company is required to consult the public, make an application for a well licence, initiate a multi-agency referral process, and begin emergency response planning before drilling activities can begin.

Since no exploratory drilling has occurred in the Fraser Valley since 1963, the Ministry of Energy, Mines and Petroleum Resources has prepared this information booklet. The booklet is based on potential questions for which members of the community may require answers.

To provide a background against which the questions and answers can be considered, a brief description of sequences of activities leading to a drilling application and well drilling are provided on the following pages. The questions and answers in this booklet discuss drilling operations and emergency planning.

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BEFORE DRILLING CAN BEGIN

1. Company geologists and geophysicists study regional geology, previous well information and available regional geophysical information to define general areas of interest.

2. The company applies to the Ministry of Energy, Mines and Petroleum Resources for geophysical permits. Applications are referred to other agencies (municipalities, Ministry of Environment, Ministry of Transportation and Highways, etc.) to determine conditions under which geophysical exploration may be carried out.

3. The company acquires Crown petroleum and natural gas rights by competitive bidding and the company may also acquire privately-held rights by negotiation with owners.

4. The company acquires additional specific geophysical information and decides if drilling is warranted. If so, the company staff select the best drilling location.

5. The company applies to the Ministry of Energy, Mines and Petroleum Resources for authorization to drill a well.

6. The Ministry of Energy, Mines and Petroleum Resources requires that:

(a) Permission be obtained from the surface landowner and the Ministry to survey and locate the proposed well location.

(b) Public consultation be conducted by the applicant.

(c) Well drilling plans and Emergency Response Plans, which conform with the Drilling and Production Regulation, be submitted for approval.

(d) The well proposal be referred to other ministries and regulatory agencies for comment as warranted by the location - Agriculture, Fisheries and Food; Environment; Forests; Municipal Affairs, Recreation and Culture; and Transportaion and Highways. Affected municipalities are also consulted.

(e) If the well is designated as a Special Well, the drilling program and emergency response planning procedures must be created and approved. These programs must be of high integrity and assure safety of the public and the personnel associated with the drilling of the well. Emergency Response Plans are designed to facilitate effective responses to possible, although unlikely, occurrences which could require the implementation of well control procedures and the orderly evacuation of residences close to the well site.

7. Providing environmental and safety conditions are met, the company is authorized to drill the well. Ministry inspectors regulate well site preparation, drilling operations and final well site cleanup and reclamation procedures. The well is either abandoned and the surface restored, or prepared for possible future production by installing the necessary equipment.

DRILLING A WELL

The area required to drill an exploratory well is quite small, usually four acres (1.62 hectares). On the site is the drilling rig itself, storage areas for drill pipe, fuel and heavy equipment, portables (housing engineering and monitoring equipment), tanks or pits for drilling fluids, and company vehicles. Staff accommodation is usually found in local hotels/motels. A campsite facility adjacent to the well site may be developed, depending upon the logistical circumstances of the particular well.

British Columbia has had over 7,100 such locations in the northeast near Fort Nelson, Fort St. John, Dawson Creek, Chetwynd and Tumbler Ridge, and some in the southeast near Cranbrook. In 1986, two wells were drilled just south of Nanaimo on Vancouver Island. To date there have been over 50 wells drilled in the Fraser Valley.

When a Special Well is drilled close to populated areas, extra requirements are placed on the operator in terms of equipment, safety measures, waste disposal, emergency planning and public consultation. The requirements are outlined in Appendices 6 & 7 of the Drilling Handbook, "Guidelines for Operator Emergency Response Plans and Public Consultation Programs for Special Wells" and the Ministry "Public Consultation Guidelines." These requirements will be in effect for all Fraser Valley operations.

Most drilling rigs used in land operations are composed of several units which are dismantled for transport from site to site. Before a rig starts drilling into potentially productive formations, a surface hole is drilled and then surface casing, composed of lengths of steel pipe, is run into the hole. Once the casing is at the bottom of the hole, it is cemented into place. This keeps the wall of the well bore from caving in, prevents inflow of groundwater, prevents contamination of groundwater, and provides a means to control formation pressures.

Blowout preventers (BOPs), situated over the well bore at surface, are also utilized to control formation pressure. Constructed to withstand (high) pressure, their size and configuration are determined by the anticipated down-hole conditions. A BOP system can quickly and effectively seal off a well, making it safe if unexpected high pressure is encountered.

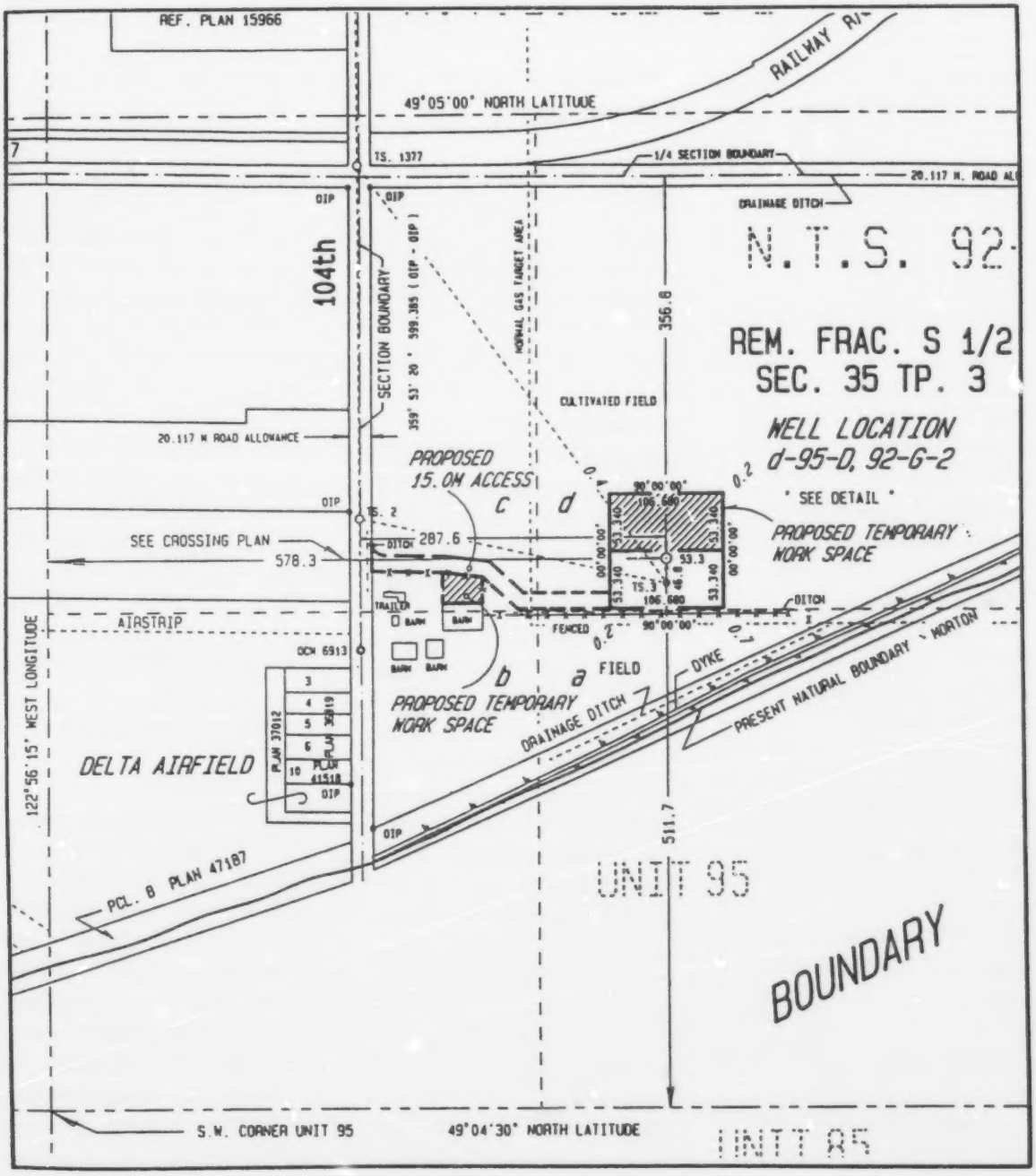
Drilling is accomplished by penetrating rock with a drilling bit attached to lengths of steel pipe. The revolving bit grinds and cuts its way through rock formations. The bit is changed as various types of rock are encountered or as its effectiveness is diminished by wear.

The bit is lubricated and cooled by a drilling fluid, called "mud." The drilling mud is pumped down the drill pipe and through to the bit at the bottom of the well bore. It returns to the surface by travelling up the space between the outside of the pipe and the inside wall of the well bore. Thus, the drilling fluid carries the rock cuttings from the bottom of the hole to the surface, where they can be inspected and identified.

Down-hole formation fluid pressures are counterbalanced by the weight of the drilling fluid, which also serves to keep the well under control when high pressure hydrocarbon or water zones are penetrated. The drilling fluid also cools the drill bit and reduces friction.

Once drilling commences, the operation proceeds around the clock until the well is finished. The time it takes to drill a well varies from several days for shallow wells, to several months for deep wells, depending on the type of rock formation, the target depth and surface access conditions.

MAP OF EAST DELTA WELL LOCATION



QUESTIONS AND ANSWERS

REGULATION, ADMINISTRATION, POLICY

1. *Why are companies looking for natural gas in the Fraser Valley?*

As they still do today, large areas of the Lower Mainland have received river sediments for millions of years. This has led to the formation of over 5,000 metres of sedimentary rocks with the potential to contain natural gas in some parts of the Valley. Approximately 50 wells were drilled in the Lower Mainland from the early 1900s until 1963. Although none of the wells found a commercial gas pool, some of the wells drilled through thick sections of porous sandstone. Several wells also encountered small amounts of natural gas. Surface natural gas seeps have also been described at several locations. About 450 wells have been drilled in Whatcom County, just south of the Fraser Valley in Washington State. While many of these wells also found "sweet" natural gas, none of them are still currently producing. Thus, companies are looking for natural gas in the Fraser Valley because many of the conditions appear right for exploration to be successful.

2. *Who makes the decisions to make subsurface petroleum rights available for competition?*

The Commissioner of Petroleum Titles, Ministry of Energy, Mines and Petroleum Resources, Victoria, determines areas where rights are posted for bidding, following consultation with affected municipalities and regional districts. Companies acquiring the rights to explore beneath the earth's surface are subsequently entitled to drill to evaluate the resource, provided that all requirements are met.

3. *What are those requirements?*

Companies are required to conform to the Petroleum and Natural Gas Act, all drilling and production regulations pursuant to this Act, the drilling and production procedural handbook, guidelines for construction and cleanup of roads, leases and seismic lines in petroleum exploration areas and conditions imposed as a result of the interagency referral process concerning a well site and access road.

4. *Do petroleum activities take precedence over other resource uses?*

Petroleum exploration is allowed following a referral to other government agencies, such as:

- Ministry of Environment; Fish and Wildlife Branch, and Water and Waste Management Branch;

- Ministry of Agriculture, Fisheries and Food; Agricultural Land Commission;

- Ministry of Forests; B.C. Forest Service;

- Ministry of Lands and Parks;

- Ministry of Municipal Affairs, Recreation and Culture; Archeology Branch; and

- Ministry of Transportation and Highways.

The agencies consider the implications for the environment and other interests. Drilling does not take precedence over public enterprises such as parks and recreation uses, nor do petroleum activities necessarily take precedence over other commercial enterprises such as farming, mining, logging, or manufacturing. However, a mixture of uses is often compatible, and there are stringent reclamation requirements placed on the petroleum operation. In the event of a dispute concerning surface access on privately-owned lands, the Mediation and Arbitration Board, a five-person Board appointed by the Province, may be asked to intervene.

5. *Why are local concerns not addressed first, before drilling rights are sold?*

It is seldom possible to know where, or indeed whether, drilling will be carried out when an exploration permit is acquired. Only after seismic exploration identifies a potential location will drilling be initiated. However, site-specific community concerns must be addressed by the operator prior to well authorization by the Ministry.

6. *How close to a dwelling can an operator drill? How close to a municipal boundary?*

An operator may not drill closer than 80 metres to a dwelling. Drilling within a municipal boundary is allowed provided safe and environmentally secure practices are followed. Such drilling is commonplace in proximity to communities such as Fort St. John and Taylor.

7. *What is required of the operator in terms of safety?*

A well drilling plan must be set out and adhered to, to assure well control at all times. The Field Operations staff and Victoria Well Authorization staff of the Ministry's Energy Resources Division have advised the company that wells in the Fraser Valley will be classified as Special Wells. As such, public consultation programs, drilling (and safety plans,) and Emergency Response Plans will be required.

8. *Will there be Ministry inspectors at the drill site to ensure regulations are adhered to?*

Yes. Inspectors will be on site at the beginning of drilling operations and at regular intervals throughout the drilling operation. They will follow up with continued inspections of the site through to reclamation.

9. *Will the drilling of a well constitute a nuisance to the community in terms of increased traffic, noise or pollution?*

The Ministry will require the use of acceptable noise abatement devices in order to reduce noise impacts from the drilling rig motors. Any drilling fluids will be disposed of in a manner approved by the Ministry of Energy, Mines and Petroleum Resources, and the Waste Management Branch of the Ministry of Environment. In the case of the East Delta well, these drilling fluids will be contained in storage tanks and subsequently removed from the site. Local traffic increases should not be significant.

10. Are the benefits worth the risk and inconvenience to the people of the Fraser Valley?

Oil and natural gas contribute between $200 and $300 million in resource revenues annually. This is about one quarter of the revenues received by the Provincial Treasury from all natural resources.

Petroleum exploration has traditionally occurred primarily in the northeast, but other parts of the province do have potential. Should a significant supply of natural gas be found in the Fraser Valley, it would add to the security of supply for the Lower Mainland, which receives natural gas by pipeline from the northeast part of the province. Seasonal price fluctuations and possible short-falls in cold winter weather would be avoided. The possibility of risk, however remote, from a well in a populated area has led to the imposition of Special Well requirements. An Emergency Response Plan is a routine requirement when wells are drilled close to residential areas. This adds a further level of safety.

11. Why haven't extensive environmental studies been done in advance as required for other major industrial developments?

Environmental requirements are assessed through the referral process and public consultation that takes place before a well is authorized. If special circumstances show the need for environmental studies, they would be required. However, a natural gas well has only limited environmental impact during drilling, and surface reclamation is required after the well is completed or formally abandoned. The potential environmental impacts are carefully mitigated through special requirements on the operation, and are seldom significant enough to justify extensive environmental studies. However, when required, studies are carried out.

12. ***Does permission to drill one well mean others following will be automatically approved?***

No. Each well must meet all requirements for safety and environmental security, and each well is approved separately. There is no automatic approval at any stage.

13. ***What if I don't want to allow drilling on my property?***

The company must negotiate access to the surface with the landowner. Any disputes between the parties are referred to the Mediation and Arbitration Board. Decisions of the Board are final.

14. ***What will the well site look like if a successful well is drilled?***

There would be a series of valves and mechanical piping placed over the well and possibly some surface piping and a flare stack on the well site. Most low-to-the-ground, producing equipment can be housed with small, portable structures.

15. What will the well site look like if the well is unsuccessful and therefore abandoned?

The surface restoration must be at least to the satisfaction of the Drilling and Production Regulation, which requires that the land be returned, as closely as possible, to the condition it was in before the well activity. If the site is in a forested area and the trees have been removed, sometimes the site will need to be replanted. On private land, the landowner may require special considerations.

OPERATIONS AND SAFETY

1. *Do the companies have the right to drill?*

Yes. Providing a well can be drilled in a safe and environmentally secure manner and if agreements have been made with surface owners, the company has the right to drill. This right was acquired through a competitive bidding procedure for Crown petroleum and natural gas rights, carried out under the Petroleum and Natural Gas Act. It may also have been acquired by freehold acquisition of the oil and gas rights.

2. *If gas is found, is it likely to be sweet or will it contain hydrogen sulphide (sour gas)?*

As none of the wells previously drilled in the Fraser Valley or Whatcom County have encountered sour gas, this is not expected in the current drilling program. Nonetheless, the most stringent safety requirements possible will be enforced.

3. *Is it necessary for the companies to drill in particular locations or is there some choice in locating a well?*

Operators usually make rather precise determinations of well locations based on careful study of geological and geophysical information. At the same time, the Ministry will ensure that any well authorization takes surface land use into consideration.

4. Could drilling or other activity affect well water?

It is possible that the surface hole drilling may result in temporary non-toxic disturbances (turbidity) of well water. The operator will conduct nearby water well testing whereby water samples will be taken prior to various stages of drilling.

The Anderson Commission, initiated in May of 1990, to review impacts of petroleum exploration in the Fraser Valley, stated that "...the chance of appreciable contamination to the potable aquifers from the proposed exploratory drilling program is remote." In addition, the commission found that the chance of appreciable contamination of groundwater by reason of drilling was "...remote in the extreme."

5. If the well is unsuccessful what would be the local effects?

After drilling is completed and if the well is abandoned, the surrounding area would not be subjected to any adverse effects. Abandonment of the well under Ministry regulations requires that the hole is permanently sealed with cement and the surface is restored to its original condition.

6. What if the well is successful?

In the event the well is capable of producing, production casing is run into the hole and the annular space between the outside of the casing and the hole is filled with cement. A well head is installed at the surface to contain and control the flow of hydrocarbons.

7. Who owns the natural gas that may be found?

Petroleum subsurface rights in most of British Columbia are owned by the Province; but in the Fraser Valley, some rights are privately-owned (freehold rights).

8. Should the community be concerned about the possibility of a well blowout?

About 7,100 wells have been drilled in British Columbia. There have been two blowouts in the last 12 years. The industry, with its in-house safety planning and drilling expertise, together with the Ministry and its regulatory safeguards, ensure that well control problems are minimized.

The Anderson Commission concluded that "...the possibility (of a blowout) is highly remote.", and that "...the chance of a blowout is no higher than, and probably much less than, one in five thousand."

9. What is a blowout? How can it be controlled?

A blowout is an uncontrolled release of well fluids to the atmosphere from a well bore. In modern operations with good equipment, proper procedures and experienced drilling crews, the risk of a blowout is largely eliminated. However, they do occur, usually as the result of human error, and that is when special safety equipment and procedures are triggered. The pressures found in underground formations are usually considerably lower than the pressure exerted by the drilling mud, which is continuously circulated during drilling operations and which fills the hole when the drill pipe is pulled up to change bits. It is possible that, where formation pressures exceed the mud pressures, gas could enter the well bore. In such cases, the blowout prevention equipment is used to prevent the blowout. This equipment (BOPs) would control the flow until such time as the drilling mud is "weighted up" by adding heavy minerals such as barite to increase the mud density.

10. Who is responsible in the event of an accident?

The operator is fully responsible in the case of an accident.

11. If there was a blowout, what would happen?

Well control procedures would be initiated immediately, in order to bring the well under control as soon as possible. Resident notification procedures, as described elsewhere in these questions, would be implemented.

12. How are blowouts prevented/controlled?

Blowouts are averted through the proper recognition of various warning signs by trained drilling crews and on-site operators' drilling representatives. These individuals must be trained in blowout prevention and possess proper qualifications. In addition, the Ministry requires operators to comply with stringent blowout prevention equipment requirements.

For Special Wells, the Ministry also requires that the operator prepare and submit an Emergency Response Plan, and a drilling plan is a routine requirement. Pressure testing of the blowout prevention equipment and casing is required on a regular basis during the drilling of a well.

EMERGENCY RESPONSE PLANNING

1. What are the details of the Emergency Response Plans?

Emergency Response Plans are designed to deal with an uncontrolled flow of natural gas and will follow guidelines set down by the Ministry of Energy, Mines and Petroleum Resources. Key agencies are consulted in the formulation of a Plan, including local government agencies (fire, police), Provincial Emergency Program, RCMP, and other provincial ministries (Environment, Municipal Affairs, Recreation and Culture, Transportation and Highways). As part of the evolution of a satisfactory Plan, the operator is required to consult with local public authorities and incorporate any appropriate feedback. The draft Plan will be made available for public comment in local government offices.

2. How can anyone be sure Emergency Response Plans are foolproof?

The Emergency Response Plan is tested at least once, prior to drilling into any potential gas-bearing horizons, to ensure that information is up to date and workable, and that the people involved know how to respond to the emergency.

3. How would people be contacted? What about farmers in their fields?

With the initiation of resident notification procedures, teams of trained company and safety and drilling contractor personnel equipped with air quality detectors and two-way radios would be deployed throughout the Emergency Planning Zone. These teams would initially station themselves at or near the nearest occupied residences.

Should measured concentrations of natural gas exceed criteria, the teams would visit those residences where evacuation is recommended. Occupants would be informed of the situation and advised to evacuate the area. They would be provided with information on where to go, evacuation routes, and contact procedures. In addition, mobile air monitoring vans would be travelling throughout the entire Emergency Planning Zone. Evacuation would also occur should these units detect gas concentration levels above the evacuation criteria in any unevacuated area.

COMPENSATION

1. If an operator wants to locate the well site and access road on lands that are privately owned, is the surface landowner entitled to compensation?

Yes. The operating company will negotiate a lease agreement with the surface landowner to which both parties can agree. If they cannot agree, they can resort to the Mediation and Arbitration Board of the Ministry of Energy, Mines and Petroleum Resources to make concluding terms of agreement and compensation for right of entry by the company.

2. What if the operation causes damage to property?

Should property damage inadvertently occur as a result of exploration activity, the company is responsible for compensating the owner for the damage. Such claims should be forwarded to the operator directly, and are usually settled immediately and amicably.

The companies are held responsible for compensation by the Ministry of Energy, Mines and Petroleum Resources, and that responsibility is secured by the resources of the company. In the Province's considerable experience with the petroleum industry, it has been found that equitable settlements on damage claims are generally achieved without recourse to the courts.

SUBSEQUENT ACTIVITY

1. What would be the next steps if commercially viable quantities of natural gas are found in the Fraser Valley?

Companies would apply to the Ministry to establish a plant operation which would process the gas and then feed into existing natural gas lines for distribution to consumers. A gas plant must comply with land use bylaws of the municipality in which it is located and would likely be sited in an industrial area.

GLOSSARY OF TERMS

GEOPHYSICAL OPERATIONS - Surveys conducted at or above the earth's surface to measure various physical properties of underground rock layers, such as their shape, density, magnetism, or their electrical properties.

HYDROCARBONS - Gaseous, liquid or solid organic compounds consisting almost entirely of hydrogen and carbon. Crude oil and natural gas are examples of hydrocarbons.

RECLAMATION - Restoration of the drill site to its original condition or better.

POROUS OR PERMEABLE FORMATIONS - Subsurface porous rock layers in which oil or gas, or both, may be found.

SHUT-IN - To close the valves at the top of a well bore. To stop flow out of, or injection into, a well bore.

SOUR GAS - Natural gas containing hydrogen sulfide or other sulfur compounds.

SPECIAL WELL - A well located in an inhabited area, and/or a well with a potential for sour gas, for which special safety measures are required.

SWEET GAS - Natural gas that does not contain significant amounts of hydrogen sulfide or other sulfur compounds.